**Practical No.: 8**

**STATEMENT:**

THE NUMBER OF FAILURE OF A COMPUTER SYSTEM IN A WEEK OF OPERATION HAS THE FOLLOWING PMF:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| No of failures | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Probability | 0.18 | 0.28 | 0.25 | 0.18 | 0.06 | 0.04 | 0.01 |

FIND FIRST FOUR MOMENTS ABOUT ORIGIN, FIRST FOUR MOMENTS ABOUT MEAN, MEASURES OF CENTRAL TENDENCY, MEASURES OF DISPERSION, MEASURES OF SKEWNESS AND MEASURE OF KURTOSIS.

**WORKING EXPRESSION:**

1. **Moments:**

Moments are the arithmetic average of various power of deviations of observations in which deciations are taken from mean or assumed mean which are used to determine the characteristics of frequency distribution. i.e central tendency, dispersion, skewness and kurtosis.

Types of moments

1. Central moments
2. Raw moments
3. **Moments about origin:**

The arithmetic average of various power of deviations of observations in which deviations are taken from assumed mean(AM) are called raw moments or moments about the origin. And it can be calculated by the given formula.

µr’ = E(xr) where, r = 1,2,3,4

1. **Moments about mean:**

The arithmetic average of various power of deviations of observations in which deviations are taken from mean(AM) are called central moments or moments about the mean. And it can be calculated by the given formula.

µr = E[ x- E(x)]r where, r = 1,2,3,4

Relationship between central moments and raw moment.

µ1 = 0

µ2 = µ’2 - µ’12

µ3 = µ’3 - 3 µ’2 µ’1 - 2 µ’13

µ4 = µ’4 - 4µ’3 µ’1 + 6 µ’2 µ’12 - 3 µ’14

1. **Central tendency:**

The value obtained by dividing total by the number of items. While representing in raw moments it is given by E(x).

i.e, µ’1 = E(x) = ∑xp(x)

1. **Dispersion:**

Dispersions means scatter or spread or variation. Based on the moment the dispersion is calculated as:

Dispersion = µ21/2

1. **Skewness:**

Karl Pearson defined the coefficient of skewness based upon second central moment and third central moment which is denoted by (β1) and given by the formula:

(β1) = µ32 / µ23

1. **Kurtosis:**

Karl Pearson coefficient of kurtosis based upon second central moment and fourth central moment which is denoted (β2) by and given by the formula:

(β2) = µ4 / µ22

**CALCULATIONS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No of failures(x)** | **Probability p(x)** | **xp(x)** | **x2p(x)** | **X3p(x)** | **X4p(x)** |
| 0 | 0.18 | 0 | 0 | 0 | 0 |
| 1 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 |
| 2 | 0.25 | 0.5 | 1 | 2 | 4 |
| 3 | 0.18 | 0.54 | 1.62 | 4.86 | 14.58 |
| 4 | 0.06 | 0.24 | 0.96 | 3.84 | 15.36 |
| 5 | 0.04 | 0.2 | 1 | 5 | 25 |
| 6 | 0.01 | 0.06 | 0.36 | 2.16 | 12.96 |
|  |  | ∑xp(x)=1.82 | ∑x2p(x)=5.22 | ∑X3p(x)=18.14 | ∑X4p(x)=72.18 |

Here,

The first moments about origin

µ’1 = E(x) = ∑xp(x) = 1.82

µ’2 = E(x2) = ∑x2p(x) = 5.22

µ’3 = E(x3) = ∑X3p(x) = 18.14

µ’4 = E(x4) = ∑X4p(x) = 72.18

Now first four moments about mean

µ1 = 0

µ2 = µ’2 - µ’12 = 5.22 - (1.82)2 = 1.907

µ3 = µ’3 - 3 µ’2 µ’1 - 2 µ’13 = 18.14 – 3 \* 5.55 \* 1.82 + 2\*(1.82)2 = -3.736

µ4 = µ’4 - 4µ’3 µ’1 + 6 µ’2 µ’12 - 3 µ’14

Again,

Measure of tendency, E(x) = ∑x\*p(x) = 1.82

Measure of dispersion, =  = 1.38

Measure of skewness = -1.418

Measure of kurtosis = 3.011

**RESULT:**

The four moments about the origin are 1.82, 5.22, 18.14 and 72.18 respectively. The four moments about mean are 0, 1.907, -3.736 and 10.949 respectively. Measures of central tendency, measures of dispersion, measures of kurtosis and measures of skewness are 1.82, 1.38, 3.011 and -1.418 respectively.

**CONCLUSION:**

Hence, the raw moments, the central moments, the dispersion, skewness and kurtosis can be computed in MS WORD and MS EXCEL.